The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited

VOL. XLIII. No. 1099 July 20, 1940 Annual Subscription, 21s. Overseas, 26s.

The By-Products of Carbonisation

THE papers that were to have been submitted to the Institution of Gas Engineers at its June meeting indicate that a distinct divergence of opinion exists within the gas industry in regard to the present and future policy in dealing with the by-products from coal carbonisation. The first divergence of opinion is between those who hold that the recovery of the by-products is a most important part of the process of gas manufacture which assists considerably in cheapening the cost of gas production, and those whose view is that the gas industry should forsake its traditional methods and manufacture gas by total gasification processes that will produce little or no recoverable by-products. The outcome of this controversy will be awaited with no little interest by the chemical industry proper since if the total gasification advocates win the day, the quantity of tar, ammonia, benzol, and sulphur available as their raw materials will be materially diminished. Methods are being worked out whereby high calorific value gas can be produced by total gasification processes. It is therefore no idle dream, and it has the advantage, it is held, that the gas industry would be able to be independent of the sale of coke, a by-product which at times is in great demand and at times must be stored and handled twice over. On the other hand, Messrs. D. M. Henshaw and C. Cooper point out that in their opinion there is at the moment no positive alternative proposal for gas production other than simple heating. It is true that the familiar by-products are generally impure materials which may fare badly in competition with the synthetic materials available from other chemical industries, but improvements in the preparation of coal by-products for the market are no doubt on the way.

The same authors point out that tar distillation has passed out of the hands of the gas engineer, " which is due to the quite logical concentration of tars from a number of gas undertakings into regional poolings." The more stringent specifications for road tars are believed to present very considerable difficulties to the small distiller. On the other hand, the President of the Institution, Mr. George Dixon, asks why all undertakings do not appreciate the value of the tar products from the normal carbonising process. He shows that the return from tar obtained by gas undertakings varies widely and ascribes this variation to the fact that some undertakings, realising the value of tar, possess their own tar distillation plants and thus get a much higher return than those who are content to sell the tar for others to make the profits.

Messrs. Henshaw and Cooper have published an interesting chart showing that the market prices for crude tar have undergone astonishing variations during the past 25 years. Starting at 15s. to 20s. a ton during the first year of the previous Great War, the price soared rapidly to 105s. in 1919, followed by an equally rapid decline to a minimum of 37s. in 1921; by the middle of 1922 it was up to 115s., dropping to 27s. in 1924. There was another peak of nearly 90s. in 1925, coming down to 18s. or 19s. in the first weeks of 1927. After another minor peak of 42s. in 1931, the price progressively fell to 15s. in 1939. It is difficult to pursue any consistent sales, development, or research policy with a raw material that fluctuates in this manner.

In general, technical practice in coal by-products appears to be developing on sound chemical-engineering lines. Greater attention is being paid to the economics of heat removal when cooling the hot gases. Electrostatic tar precipitators are becoming standard practice. If ammonia recovery has now " degenerated into the status of the elimination of an impurity " (*vide* Henshaw and Cooper), the use of automatic distillation plants coupled with the utilisation of exhaust steam for distillation has saved both labour for supervision and materials and has enabled even small works to manufacture concentrated liquor without incurring costs, and often at a profit. An interesting development in heat abstraction and ammonia recovery is the adoption of a washer-cooler in which the gas is cooled in a tower scrubber by contact with cooled gas liquor, and this liquor is re-cooled in closed tubular racks over which water flows. Many methods have been suggested to deal with effluents, particularly waste ammonia liquor from the stills, but it is concluded that the only means in which there is a fair certainty of the result is treatment in bacterial sewage beds.

The use of large quantities of wash oil for the recovery of benzol and simultaneously of organic sulphur compounds was introduced commercially by Messrs. Henshaw and Cooper following experiments by The Gas Light & Coke Company. This was rendered possible by vacuum distillation of the wash oil; again, this permits of further economies by using exhaust steam for the purpose in place of the live steam required by the normal process. A further development of this process permits of removal of most of the organic sulphur without the removal of the greater part of the benzol. These authors are disposed to be critical of the gas industry because no steps are taken to augment the yields of by-products, as is done in coke-oven practice.

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NOTES AND COMMENTS

Compulsory Registration

BY the time this issue of THE CHEMICAL AGE appears in print, all chemical engineers in this country, as well as the members of most other branches of the engineering profession, will have applied for registration with the Central Register. Failing that, they will have rendered themselves liable to imprisonment for a term up to three months, or to a fine not exceeding £100, or to imprisonment and fine, according to an Order made under the Defence Regulations by the Minister of Labour and National Service. The Order took effect from last Sunday, July 14, and application had to be made in writing to the Central Register within five days of that date. It is stated that occasions may arise when it will be necessary for the Minister to use his emergency powers to direct the employment of persons in what are known as the "scarcity categories" of the Central Register. Of the 22,000 engineers now on the Register only some 800 are not in employment, and it is estimated that, by the new Order, another 30,000 names will be added. Chemical engineers and their confrères may take it as a compliment to their usefulness that they have been singled out in this way for compulsory registration; and those who have so far been discouraged from registering by their employers—a state of affairs that was mentioned at the S.C.I. meeting last week—will now have the satisfaction of knowing that their services are at the disposal of the nation, whenever and wherever required.

Welfare of War Workers

VALUABLE aid towards securing the efficiency of the war effort in the workshops of the nation is offered by a booklet entitled *Elements of Industrial Welfare and Personnel Management*, issued by the Industrial Welfare Society, 14 Hobart Place, London, S.W.1 (price 4d. post free). This booklet is a successful attempt to set out, in short and simple form, the duties of a welfare and personnel supervisor or department in war time. Such duties are divided into three main branches: (1) the recruitment, selection and allocation to jobs of new workers as these are required; the keeping of employee records; the instruction and training of new workers and transfer and promotion within the factory; (2) the supervision of working conditions and arrangements in the factory as they affect the health, safety, and well-being of the workpeople; and (3) the establishment of close co-operation between employees and management as a means of ventilating suggestions and grievances; and attention to personal problems. How these functions are best to be carried out in both large and small establishments is admirably and clearly explained in the pamphlet's 19 pages. Its primary object is, of course, efficient production for the war effort, but it is specially emphasised that welfare work has been most successful towards this end when it has placed the individual well-being of the worker as its first consideration. After all, it is practical idealism of this kind that we are fighting for, against the mass exploitation of the workers for the benefit of the State.

Accidents in War Time

THE current issue of *Occupational Psychology*, published by the National Institute of Industrial Psychology, contains a significant article by Mr. Eric Farmer, of the Industrial Health Research Board, on Accident Proneness and Accident Liability. After indicating the main factors determining accident incidence and the results of investigating accident proneness, Mr. Farmer deals with the prevention of accidents during war time. "The necessity of increased production and the dilution of labour brought about by war conditions will greatly increase accident rate, unless special precautions are taken," he says, and further: "If the length of the working spell is unduly increased, hourly output is reduced and the accident, sickness and absentee rate increased." In this connection Mr. Farmer emphasises the great importance of training ordinary workers for unfamiliar tasks and the even greater necessity of adequate training for young and inexperienced workers. He stresses the importance of accidents in relation to nervous tension and unrest, and urges that industrial accident rates should be most carefully watched for evidence of strain.

Benzol Recovery Committee

THE Mines Department has already made it clear that the maximum production of benzol of all qualities is urgently required in the national interest. Much has been done recently to increase the quantity of benzol recovered, but it has been estimated that a considerable further quantity of crude benzol might reasonably be recovered at gasworks and coke ovens by the following means: (a) increasing the efficiency of existing recovery equipment at gasworks and coke ovens; (b) expediting the installation of equipment already on order; (c) the installation of recovery equipment at certain gasworks which do not at present recover benzol. The Secretary for Mines, acting upon the recommendation of the Committee on High Temperature Carbonisation, has now set up a committee with the following membership:—Mr. George Evetts (chairman), Mr. E. V. Evans, O.B.E., Mr. D. M. Henshaw, Dr. H. Hollings, Mr. D. M. Macdonald, Mr. A. W. Middleton, Mr. J. F. Ronca, O.B.E., Mr. A. W. Smith, and Mr. J. A. Beckett (secretary). The Committee's terms of reference are:—"To advise and assist as to the steps to be taken under war conditions to increase the quantity of crude benzol recovered at gasworks and coke ovens and the yields of products obtained by the refining of the crude benzol." The Committee has already started on its task and the Secretary for Mines wishes to take this opportunity of appealing to all those concerned to co-operate to the full with Mr. Evetts and his colleagues in their work, the success of which must in large measure depend upon the goodwill of the gas and coke oven industries. The Committee will be glad to give assistance and advice to any undertakings which care to get in touch with them. Communications should be addressed to the Secretary, Advisory Committee on Benzol Recovery, Mines Department, Millbank, S.W.1.

SOLVENT RECOVERY IN AMERICA

Activated Carbon Method Preferred

INTERESTING comparisons may be made between the following paper and the article by Mr. Hugh Griffiths which appeared in THE CHEMICAL AGE on June 24, 1939. The present paper is an adaptation of an article contributed by Mr. Arthur B. Ray, of Carbide and Carbon Chemicals Corporation, New York, to the Report on the Conditioning of Gases and Air published by *Chemical and Metallurgical Engineering* (May, 1940; pp. 329-332).

American industries use tremendous quantities of low-boiling organic liquids—generally spoken of as "solvents"—in carrying out various manufacturing operations. In many cases, these solvents act merely as dissolving or carrying media for materials such as nitro-cellulose, cellulose acetate, synthetic resins, plastics, and rubber products, and are vaporised into the air during the manufacturing process. In some cases solvents are used to extract oils from materials such as soya bean meal. Efficient recovery makes it possible to eliminate solvent cost as a first consideration and makes it unnecessary to use a cheap solvent if a higher priced solvent will improve the quality of the manufactured product.

Since in most cases the solvents are vaporised in manufacturing operations exposed to air, the recovery must be made from vapour-air mixtures. And since most of the commonly used solvents are inflammable when their vapours are mixed with the proper amount of air, vapour concentration is particularly important from the safety standpoint.

If the concentration of a vapour in air is kept below the lower limit of inflammability, the mixture cannot be ignited or exploded under normal conditions of temperature and pressure and the recovery of vapours under these conditions presents no hazards. Likewise, if the concentration of vapour is kept above the upper limit of inflammability the mixture is not inflammable or explosive, but in working with these concentrated mixtures there is always the possibility that the concentration may get into the explosive range by dilution with air leaking into the system or by failure to vaporise the solvent at the required rate to maintain the high concentration. Therefore, where high solvent vapour concentrations are necessary to carry out a process, it is advisable to employ an inert atmosphere or a non-inflammable solvent to avoid hazards.

Since it is impossible in this brief article to discuss all the possible recovery methods or, in fact, any one method in detail, we shall limit our discussion to recovery by condensation, absorption with liquid media, and adsorption with activated carbon.

Recovery by Condensation

Solvent vapours can be recovered by condensation when the vapour-air mixture is cooled below the dewpoint. The solvents are usually vaporised at high temperature and the mixture is cooled by bringing it into direct contact with cooling media such as water or refrigerated solutions. When the cooling medium is water, the temperature cannot ordinarily be reduced below 15° C. The vapour pressure of practically all common solvents at this temperature is such that the minimum concentration is either in or above the explosive range. This means, of course, that such a condensation process of recovery must unavoidably handle hazardous concentrations. If air is replaced by an inert atmosphere to avoid the hazard, the condensation process still has objections. Since the concentration cannot be reduced below a rather high value, the material being processed cannot be completely freed of the solvent, and the vapour-laden air must be recirculated to avoid large loss of solvent. Because of unavoidable solvent losses, such a system does not ordinarily recover more than 60 to 70 per cent. of the solvent and usually much less. Water vapour present may also be condensed and, if water-soluble solvents are recovered by such a condensation method, the condensate must be distilled. Because of the disadvantages of such a system, it is not widely used, having been largely replaced by the activated carbon system. There are, however, a few condensation systems of the type described in operation where it is advantageous to keep the processed material in a high concentration of the vapour of the solvent.

Solvents used to extract oil from soya bean meal and such materials are generally vaporised from the material by reducing the pressure and heating to a moderate temperature. The small amount of solvent carried out of the systems in the saturated air discharged from the vacuum pumps is generally recovered by means of activated carbon, but the bulk of the solvent vaporised from the meal is recovered as is logical by merely condensing it in suitable equipment cooled by water at normal temperatures.

Recovery by Absorption in Liquids

To recover solvent vapours by absorption in liquids it is necessary to pass the vapour-laden air in efficient contact with the absorbent under conditions which will permit the liquid, at a suitable temperature, to extract the vapour from the air more or less completely. Contact may be effected by the use of spray chambers or scrubbing towers. When water-soluble solvents are to be recovered, water is the usual absorbent, and when the absorption method is used to recover oil-soluble solvents, a mineral oil is the usual absorbent. Both of these absorbents hold solvent vapours in accordance with Henry's Law which states that a volatile substance dissolved in a liquid exerts a vapour pressure proportional to the amount of the substance present.

The method of recovering solvent vapours from air by absorption in a mineral oil having a high vapour pressure is of limited applicability and use. In general, it may be said that when the concentration of the vapour to be recovered is low enough to be safe, recovery by oil absorption is relatively inefficient and expensive. The oil absorption method is, of course, widely used to recover gasoline from natural gas and light oils from manufactured gas under favourable high pressure conditions and where the presence of impurities in the gas makes other methods impracticable

Before the development of the modern activated carbon system of solvent recovery, water absorption was the method most favoured for the recovery of such widely used water-soluble solvents as acetone and ethanol. When acetone is recovered by water, very cold well water or water cooled by refrigeration is generally used. Since the efficiency of recovery and concentration of acetone in the water leaving the scrubber are both affected by the vapour concentration and the temperature of the water, the concentration is kept as high as possible and the temperature as low as is practicable. For safety reasons, the concentration is usually kept below the explosive range, but because the efficiency and expense of recovery are both favoured by high vapour concentration, the possible factor of safety for absorption systems (as they are usually operated) is less than for the activated carbon system.

While the type of scrubber and recovery conditions may vary, it will be of interest to give available data regarding one large modern absorption plant. In this plant the vapour-laden air is passed to a multistage spray-washer type of scrubber in which the solvent-air mixture is passed through successive chambers into which water is sprayed, this water being pumped from one chamber to the next counter-current to the flow of air. Concentration of acetone vapour in the inlet air may be as high as 1.75 per cent., but occasionally is considerably lower. The air leaving the scrubber always contains some acetone vapour and under favourable conditions the concentration may be as low as 0.06 per cent. The plant is designed to recirculate the effluent air from the scrubber back to the process, but some leakage is unavoidable, with consequent loss of acetone. The water entering the first scrubber

is at a temperature of approximately 1° C., and approximately 300 tons of refrigeration are required per ton of recovered solvent. The water-acetone solution leaving the scrubber contains approximately 2.6 per cent. acetone by weight, necessitating unusually large rectification equipment. It is reported that the over-all recovery varies with the inlet vapour concentration and other conditions, but may range between 92 and 95 per cent.

Since an activated carbon system is operated under the same conditions as the water absorption system just described, except that the vapour concentration with the carbon system is lower, it is of interest to compare the two. The carbon system requires no refrigeration and effects substantially complete recovery of the acetone from the air even though the vapour concentration, temperature and humidity of the inlet air vary considerably. The acetone-water solution steamed out of the carbon contains 20 to 33 per cent. acetone by weight. The over-all recovery by the carbon system is reported to be from 98.5 to over 99 per cent. Reported comparative data regarding utility requirements of the two systems are given in the accompanying table.

	Per 1000 lb. of Recovered Acetone.	
	Water absorption	Activated Carbon
Steam at 415 lb. per sq. in. and 65.5° C. superheat	5520 lb.	None
Steam at 15 lb. per sq. in.	4040 lb.	3960 lb.
Water at 12.75° C.	17,445 gal.	8750 gal.
Electric power	251 kw-hr.	82 kw-hr.

Recovery by Activated Carbon

The most generally used method of recovering solvents is by adsorption with activated carbon. This solid adsorbent, when of the proper type, is especially made for efficient and economical recovery of solvent vapours under widely varying conditions. The carbon adsorbs substantially all the vapour from the air regardless of variation in concentration, temperature and humidity. Because the adsorbed solvent has practically no vapour pressure at normal temperatures, the carbon system is particularly adapted for the efficient recovery of solvents present in air in low concentration. This means that carbon recovery systems can always be designed for operation without hazard because the vapour concentrations are always below the inflammable range. The type of activated carbon generally used in the United States has a high specific adsorptive power for organic vapours and therefore recovers such vapours efficiently when water is present in the air or in the carbon. Since activated carbon adsorbs all the usual low-boiling solvent vapours, it can be used to recover practically any single solvent or any combination of low-boiling solvents vaporised in manufacturing operations.

In order that the adsorptive properties of activated carbon may be utilised to effect recovery of solvent vapours, special equipment and operating procedures have been developed. The filtered and cooled vapour-laden air is drawn under automatically controlled conditions from the solvent-vaporising operation and is passed to the bed of activated carbon in one of the adsorbers. The activated carbon adsorbs and holds the solvent vapour and denuded air is discharged to the atmosphere. The passage of vapour-laden air is continued until the activated carbon bed has adsorbed the desired quantity of solvent. If the vapour is passed to the carbon bed at a constant rate, the desired charge is obtained by keeping the adsorber in service for a definite period. If, however, as is most often the case, the vapour is passed to the adsorber at a widely varying rate, an especially sensitive vapour detector in the air exhausted from a portion of the carbon bed indicates when the bed is charged to the proper limit. When the carbon bed in one adsorber is charged with vapour, the vapour-laden air stream is either manually or automatically switched to another adsorber. The adsorbed solvent is then driven out of the charged adsorber by introducing low-pressure steam at a controlled rate below the carbon bed. The steaming is continued for about 15 to 60 minutes and then the adsorber is ready to be placed in service again. The steam passing through the charged carbon causes the release of the adsorbed solvent vapour and the steam-solvent vapour mixture discharged from the adsorber is condensed. If the solvent is not appreciably soluble in water it is separated from the water by an automatic continuous decanter. If the solvent is completely soluble in water it is separated by distillation.

While many recovery plants are of the type just described, other activated carbon plants for the most efficient recovery of valuable solvents are operated so as to include a period after the steaming operation in which the carbon is partially dried and cooled. Various modified operating procedures may be employed to obtain most efficient recovery under special conditions. Some plants which are not required to operate continuously contain only one adsorber which is charged during several hours' operation and is then steamed and cooled and returned to service when required. Many large plants contain a number of adsorbers operated in parallel to give the desired air-handling and solvent-recovery capacity.

Details of Operation

Recovery of solvents by adsorption is accomplished at low cost as the following information regarding recovery by an activated carbon system shows. The steam requirement ranges from less than 3 lb. to about 5 lb. per lb. of solvent recovered. The high steam consumption is required when the recovered solvent must be redistilled to make it suitable for re-use. The consumption of electric power varies with the concentration of the vapour in the air. In typical recovery plants where the concentration of the solvent vapour is 40 to 50 per cent. of the concentration at the lower limit of the explosive range, the power consumption is approximately 0.04 to 0.08 kw-hr. per lb. of solvent recovered. For recovery of a solvent such as benzol, the requirement of water at a maximum temperature of 21° C. is approximately 7 gal. per lb. of solvent recovered. For the recovery and redistillation of a solvent such as acetone, the requirement of water at 21° C. is approximately 9½ gal. per lb. of solvent. The operation of the recovery plant is simple, and when the operations are manually performed one operator is all that is required for even a large recovery plant. Where the operation of the recovery plant is automatic no regular operator is required, and it is only necessary to check over the equipment periodically and set the instruments. The cost of maintaining the plant in first-class operating condition is low because of the use of stoutly-built equipment and of corrosion-resistant alloys where necessary. Annual maintenance cost rarely exceeds 5 per cent. of the cost of equipment.

HYDROGEN SULPHIDE IN GASES

A test for hydrogen sulphide in industrial gases, which is claimed to be much more accurate than the usual process with lead acetate test papers, is described by Strada and Macri (Ann. Chim. Applicata, *29*, p. 64). The test is made in a glass flask of one litre capacity stopped with a rubber stopper, through which run two glass tubes, each with a cock. Also running through the stopper are a funnel with a control cock, and a thermometer. The flask is first filled with the gas to be tested by connecting one of the tubes to a supply of gas, and opening the cocks on both tubes. After two or three minutes, the cocks can be closed, and the pressure of the gas in the flask brought down to atmospheric pressure by opening one of the cocks for a moment and immediately closing it again. A quantity of a solution consisting of 25 grams of zinc acetate in 5 c.c. of acetic acid is poured into the funnel, and allowed to run down into the flask by opening the cock on the funnel. The flask is then shaken thoroughly, after which a quantity of a 10 per cent. solution of iodine is poured into the flask, and the excess of iodine titrated with sodium hyposulphite. The test requires about ten minutes to make, and is described as extremely accurate.

NOTES FROM WORKS SAFETY JOTTINGS

Special Precautions for Chemical Works

by JOHN CREEVEY

THE precautions which need to be observed in chemical works are wider and more varied than would appear from momentary consideration; likewise in works which are not chemical works in the true sense, but where chemicals are handled in quantities as necessary for the processing of some industrial raw material. It is only by knowledge of the safety precautions which apply in the tasks he has to carry out that the worker can become truly "safety-minded." Those tasks may be either mechanical or physical, or correctly designated as chemical.

* * *

Mechanical and physical operations constitute a notably large proportion of duties. There are dry materials to handle, and liquids as well, involving the use of many different types of equipment—from a rough survey, perhaps forty or more in number. Dry materials have to be prepared in powder form by crushing, grinding, pulverising, etc. Mixing, considered generally, includes such operations as spraying, agitating, kneading, emulsifying, and dispersing. Solutions have also to be prepared, involving processes of leaching, straightforward dissolving, extraction by percolation or washing, and absorption of gases. In one continuous recitation can be mentioned the crystallising of materials from solution (with such equipment as agitators, rotary crystallisers, rocking crystallisers, grainers and evaporators of the salting type); the vaporising of liquids, the subliming of solids, the melting of solids; filtration (with its variants of filter presses, false-bottom tanks, continuous rotary filters, thickeners, and centrifugals); screening (considered likewise for vibrating screens, rotary screens, grizzlies, trommels, bolters or whatever they may be termed).

* * *

Prominent for nearly all these mechanical and physical operations there is the protection of the workmen from gearing and similar sources of injury, by means of guards and fences. Dust-laden atmospheres may demand the use of suitable masks to give protection for lungs or eyes, or both; especially for dusts of siliceous or calcareous nature. Corrosive liquids require the use of goggles and gloves, sometimes masks and protective clothing generally; this is the case where corrosive or poisonous liquids are being mixed by agitation. The movement of liquids from storage tanks to reaction vessels, or in circulation upon the plant by pumping makes it needful to watch pressures that may become excessive, with danger from those liquids that are corrosive. Here, too, there is ever a need for pipe lines to be coloured to indicate what is passing through them; a fitter may be needed at any moment to make some adjustment, a valve can be turned in error quite easily if there is no outstanding indication of the pipe system of which it forms part. Both the preparing of solutions and the crystallising of materials from solution necessitate certain precautions to guard against danger from inflammable and poisonous solvents; so also do distilling, evaporating and drying in currents of air from which the solvent vapour is subsequently recovered. In processes of melting there is need to avoid spluttering in the melt, and spattering when the melted material may be poured into some other receptacle. Quite a lot of commonsense; in some cases particularly obvious. Yet when accidents are reviewed how often is it found that the trouble arose through too familiarity with a common task. Even where high-tension electrical equipment is in use, as in the case of electrical precipitation for dust and fumes, accidents do happen in spite of the warning that is continuously displayed and the precautions adopted to make the workman safe—if they are heeded.

From mechanical and physical operations we pass to truly chemical operations; types of reaction are numerous, and each may demand some safety precaution of its own. Generally, there is indicated the need for protection against corrosives, poisonous gases and vapours, and poisonous dusts; also a medley of health hazards from continuous exposure or contact, some of which can be avoided by simple precautions, whilst others may need periodical inspection of workmen to avoid serious troubles. The frequent testing of equipment and the checking of pressures in vessels and pipes can do much to indicate possible sources of trouble by the escape of poisonous vapours.

* * *

Take a few of the processes into more detailed consideration. In the making of nitro compounds, such as nitrobenzol, nitrophenols, picric acid, etc., even with standard equipment designed for the purpose, there are such safety measures as the use of gloves, goggles and sometimes fully protective clothing or, as a general measure of safety, the use of wool clothing exclusively in acid-handling; provision of safety showers has also to be considered, for even with rigid safety precautions accidents have a way of happening—and in the absence of a suitable and readily accessible shower the consequences may be serious. Many nitro compounds, moreover, are explosive or inflammable, a point that needs to be remembered should any unforeseen circumstances arise, both in operation of process and in handling and storing the products. Methods for moderating the violence of a nitrating reaction are known and have to be put into practice; concentrations of acid and rates of temperature rise have to be kept under control, and care must be exercised in the precision with which weak acids are brought to strength by the addition of strong acid to enter into the process again. The making of amino products involves health hazards and the need for periodical medical inspection; milk taken daily goes some way towards combating cyanosis. There are also fire and explosion risks. Where the reaction is carried out under pressure in an autoclave, the equipment should be kept under observation from behind a protective barrier in the absence of any other safety measures, especially where a reaction is not standardised or is being carried out under modified conditions. Excess pressures in autoclaves must be watched also in the case of sulphonations, as in making β-naphthylsulphonic acid. Oxidations and hydrogenations have to be controlled to avoid the danger of explosion of the equipment; in the former, means have to be adopted to control any partial oxidation to its desired stage. Frequent testing of the equipment employed is everywhere indicated, with particular attention to control instruments. Sometimes the need for tight joints is especially prominent, as where alkyl and aryl compounds are being made and there is risk of alkyl lead and mercury poisoning.

* * *

Just what the men operating a particular process need to know and understand is quickly to be noted down for their instruction, if the process and the reactants are carefully reviewed by someone on the administrative staff. Where the precautions have already been noted in the literature, it is wise to consider them from an independent source, and to review each point separately, with due consideration of the actual plant to be used, the situation of the plant in the works (*e.g.*, its proximity to other processes), and from the point of view of the actual personnel employed at the works—or at least those who are likely to come in contact with the plant—in operation (not forgetting accessory features or work), in maintenance or repairs, and in sampling and tests.

SOAPS AND SAPONIFYING AGENTS*

Special Qualities of the Amino Soaps

FAST strides have been made in the technology of saponifying agents since the early housewives lixiviated potash from wood ashes. Until triethanolamine was placed on the market a few years ago the only saponifying agents available for soapmakers were caustic soda, sodium carbonate, caustic potash, potassium carbonate, ammonium hydroxide and ammonium carbonate. These chemicals are highly alkaline stable materials, with the exception of ammonia which is more or less volatile, even in the combined state as ammonia soaps. Solutions of soaps made with any of these alkalies, have a *p*H value of over 10, while those soaps made with organic amines show a lower *p*H.

Saponification takes place in molecular proportions, as does any other chemical reaction. For instance, in the saponification of beef tallow, which we all know to consist chiefly of glyceryl stearate, the molecule of tallow (glyceryl stearate), which has a molecular weight of 890, combines with three molecules of NaOH which have a combined molecular weight of 120, in the proportion of 890 : 120, to form sodium stearate and glycerin. Therefore, to saponify 100 pounds of tallow, about 14 pounds of caustic soda would be necessary. Practical soapmaking bears this out. Similarly, if the saponification were carried out with caustic potash, the ratio would be 890 : 168 or to saponify 100 pounds of tallow, about .9 pounds of 100 per cent. potash would be required.

Fats and oils, consisting of the different fatty glycerides, have different combining weights or saponification values, as the soapmakers call them. Chemical handbooks may be consulted for these values. It should be added that the combining weights are the same, whether the saponification is carried out by the cold, semi-boiled or whole-boiled process.

Soda, Potash, and Ammonia Soaps

In concentrated form, the soda soaps are hard and form the basis of most of the laundry and textile soap chips, powders, and detergents. Other properties depend to some extent on the fats with which the soda is combined, and largely on other added products, such as alkalies, abrasives and so on, which constitute the "filler," if and when used. Caustic soda may be used to saponify neutral fats and oils (glycerides), while carbonate of soda will react chemically only with the fatty acids (deglycerinated fats and oils). Saponification with sodium carbonate is cheaper, but it is used only in special cases. In large scale soap-making, rosin is so saponified, but owing to the great evolution of carbon dioxide, and consequent spattering and rise of the soap in the kettle, saponification with carbonates is avoided in many soap plants.

The potash soaps are generally soft or quite plastic. They are easily dissolved in water and, with the exception of castor oil soap, these soaps give good lather. They find use in wool scouring, bases for shampoo, floor scrubbing, carpet cleaning, disinfectants, shaving soap and cream, and in other cosmetics. They range from translucent to transparent in appearance, the actual colour depending on the oil or fat used. Stearate soaps are pearly.

Most of the ammonia soaps are soft and not quite as stable as the soaps made with caustic soda and potash. They are used as cleaning compounds, in metal polish, in dry cleaning, and as emulsifiers. Ammonia soaps are formed by reaction with various fatty acids. Neutral oils do not readily saponify with ammonia. The volatility of ammonia is of distinct value in some cases, where it is used to saponify a resin such as shellac. Upon drying and consequent volatilisation of the ammonia, the hardness and lustre of the original shellac is restored, giving water repellency to the product.

In recent years a number of organic chemicals have appeared on the market, which in special cases may be used to replace the older alkalies. First place among these is held by triethanolamine ($CH_2CH_2OH)_3N$. According to its producers, this consists of a mixture of mono-, di-, and triethanolamine. It is a colourless, viscous, hygroscopic liquid, which combines with fatty acids, in the proporton of two parts of fatty acid (oleic) to one part of triethanolamine, to form neutral soaps, with lower *p*H than those of soda and potash. These are powerful emulsifiers which are used for polishes, textile specialties, leather compounds, insecticides, cutting oils, and water paints. The ethanolamines, furthermore, make good solvents or dispersing agents for such organic substances as shellac, casein and rubber. One of the most important properties of triethanolamine soaps, which is not possessed by ordinary potash and soda soaps, is that the amino soaps are soluble in oil, and hence produce oil-in-water emulsions. Monoethanolamine oleate has been tried as a medicine for varicose veins. Meyer (Amer. J. Surgery, 1940, 628) found that it is less toxic than sodium morrhuate generally used, and does not produce allergic reactions.

Some Amino Soaps

In general it may be said that fatty acid soaps of the amines are valuable for several reasons : ease of preparation, buffered alkalinity, high emulsifying power and solubility in oil. They are useful in formulation of dry cleaning soaps, soluble oils and cosmetic creams.

Ethylene diamine ($H_2NCH_2CH_2NH_2$) is a colourless water-soiuble liquid with ammoniacal odour. It has the lowest equivalent weight of any organic amine, 30 lbs. being required to combine with 282 lbs. of oleic acid.

Morpholine [$NH(C_2H_4)_2O$] is a colourless, mobile liquid with a penetrating ammoniacal odour. It is a mild base and forms soaps like other amines. The oleate and stearate are useful in the preparation of stable oil-in-water emulsions. They are of outstanding value in the formation of coating emulsions, such as in polishes, paper coating, leather dressing, paint, asphalt, sizing and lacquer emulsions, where it is desirable that the resultant film after drying shall not again emulsify. On drying, morpholine volatilises from the emulsion film, leaving it practically water-resistant.

Tri-isopropanolamine ($CH_3CHOHCH_2)_3N$ is a crystalline pure white solid, melting at 45° C. The manufacturers advise that there is also available a mixture of tri-isopropanolamines that is liquid. These form stable non-darkening soaps, which are excellent emulsifying agents and are completely soluble in hydrocarbons. G. W. Fiero investigated these soaps, and found that cold creams produced with them were softer than those prepared with triethanolamine, and that they did not discolour as much with age as do triethanolamine creams. As for detergency, this investigator found that tri-isopropanolamine oleate was the least efficient and triethanolamine oleate the most efficient. Fiero (J. Am. Pharm. Assoc. 1939, 28, 284-5) in a series of washing tests with a miniature washing machine, using pure salts of triethanolamine, found also that the laurate, oleate, myristate and palmitate (in the order of decreasing efficiencies) have definite detergent power, but that none were as good as ordinary soap. He also found that the triethanolamine soaps of common mixed fatty acids possessed detergent efficiency in the following order—tallow fatty acids, coconut fatty acids, and red oil.

Diethylene triamine ($NH_2CH_2CH_2NHCH_2CH_2NH_2$) is a hygroscopic viscous liquid, completely soluble in water and hydrocarbons. It is strongly alkaline and forms soaps with fatty acids. Such soaps dehydrate to amides. Triethylene tetramine [$NH_2(C_2H_4NH)_2C_2H_4NH_2$] is a viscous water-soluble liquid, less volatile than diethylene triamine. It combines with fatty acids to form soaps which are detergents and softening agents. Monoamylene amine ($C_5H_{11}NH_2$) is a colourless liquid with a distinct ammoniacal odour, miscible with water and most of the common solvents. It combines readily with fatty acids to form soaps soluble in mineral and vegetable oils. Ninety-six parts of this amine are required

(*Continued at foot of page* 33.)

*Adapted from a paper by Benjamin Levitt, F.A.I.C., in *Chemical Industries*, 1940, *26*, 6, 726-8.

Dicarboxylic Acids

Industrial Uses of the Saturated Series

TECHNICAL interest in some of the saturated acids in the series from oxalic to sebacic acid has increased in the last few years, partly with the discovery of cheaper production methods and partly with the emergence of new derivatives with distinctive properties.

The first member of the series, oxalic acid, is still the most important. Its use is well established in the dyeing and printing, leather, ink-making and photographic industries. No substantial improvements in manufacturing technique have come to light in recent years. Malonic acid (methane dicarboxylic acid) is produced from monochloracetic acid, but not at a price to attract widespread interest. The next member, succinic acid (1,2-ethane dicarboxylic acid), is now available at the lowest price in history since its production from the cheap maleic acid obtained by oxidation of naphthalene or benzene (CHEMICAL AGE, 1939, *40*, 1037, p. 349). Glutaric acid (1,3-propane dicarboxylic acid) has not yet reached the ranks of low-priced chemicals, although some promising methods are in course of development. It is obtainable in excellent yield by oxidation of the cheap cyclopentanol, as well as by vapour phase oxidation of alkyl cyclohexanes from Californian crude oil. Adipic acid (1,4-butane dicarboxylic acid) is being made on a considerable scale by oxidation of cyclohexanol. β-Methyl adipic acid is similarly derived from *p*-methyl cyclohexanol. Pimelic acid (1,5-pentane dicarboxylic acid), suberic acid (1,6-hexane dicarboxylic acid) and azelaic acid (1,7-heptane dicarboxylic acid) are not yet produced at sufficiently low prices to merit general interest. Sebacic acid (1,8-octane dicarboxylic acid), on the other hand, has for some years been made on a technical scale in good yield from castor oil. A brief summary of some of the more recent applications of a few of the above acids follows herewith.

Plasticisers and Resins

Succinic, adipic and sebacic acids are used on an important scale in the manufacture of plasticisers and resins. Succinic acid and sebacic acid take the place of maleic or phthalic acid in condensations with polyhydric alcohols, but yield products with different properties. The products are essentially non-drying oils or thermoplastic resins. Combinations with the phthalic type of resin have found some application; a resin suitable for the production of flexible oil-resistant tubing is thus prepared by reacting glycerine, phthalic anhydride, ethylene glycol and succinic acid in suitable proportions. Glycol esters of succinic acid are plasticisers for nitrocellulose and cellulose acetate. Ethylene glycol succinate-acetate is a waxy solid; triethylene glycol succinate-acetate is a viscous oil. Sebacic acid is particularly useful in the production of tough, rubbery resins, *e.g.*, by condensation with glycerine and castor oil. Adipic esters with cyclohexanol and methyl cyclohexanol were introduced some years ago as cellulose ester plasticisers. Esters with long-chain alcohols such as dilauryl adipate and dilauryl succinate are excellent water-resistant plasticisers for nitrocellulose. Another class of plasticiser is represented by the succinic ester of hydrogenated abietyl alcohol.

Esters of succinic and sebacic acid with unsaturated alcohols can be polymerised by standard methods, *e.g.*, vinyl succinate, diallyl succinate, 2-chloroallyl succinate and diallyl sebacate. Some of these esters also participate in copolymerisation reactions (*e.g.*, with styrene). The products are plastic, glassy or rubbery materials. Butyl succinate is a possible starting material for synthetic rubber, although not of immediate practical interest. It can be reduced to tetrahydrofuran which readily undergoes dehydration to butadiene. Some work has recently been published on cellulose esters of succinic acid. Cellulose diacetate monosuccinate (m.p. 172° C.) is soluble in acetone, methyl ethyl ketone, ethyl acetate, and also in dilute ammonia and caustic soda. Mixed esters of this type may find application as special finishes and sizes.

In the textile industry certain amine compounds of the dibasic acids have been put forward as assistants. Diethylaminomethylamine succinate, dioleylamine succinate and the like are used in conditioning baths for cellulose ester yarns prior to knitting. The treatment is effected in aqueous baths containing olive oil or similar lubricant. The development of nylon textile fibres resulted from the discovery of the polyamide resins, products of condensation between adipic acid, sebacic acid and the like on the one hand and aliphatic diamines on the other. Hexamethylene diamine, which has been paired with adipic acid in this type of reaction, is itself produced from adipic acid by way of its amide. Since adipic acid is derived from the phenol of coal tar, nylon textiles are 100 per cent. synthetic.

The acids under review have found some applications in food manufacture, medicine and perfumery. Ethyl malonate is an intermediate in the preparation of barbituric drugs. Mercury compounds which have been found to possess great germicidal power include monophenyl mercury succinate, diphenyl mercury adipate, diphenyl mercury azelate and diphenyl mercury oxalate. Adipic acid has been used in place of tartaric acid in baking-powder preparations. Ethyl succinate is reported to be a good solvent for extraction of fruit and vegetable perfumes. Diethyl sebacate possesses a melon-like odour. The ethyl, isopropyl, amyl and cyclohexyl esters of adipic acid have been proposed as perfume fixatives.

(*Continued from page* 32.)

to saponify 282 parts of oleic acid. It is possible to secure both oil-in-water and water-in-oil emulsions.

For textile lubrication 3.75 per cent. monoamyl oleate is thoroughly mixed with a 28° Bé. paraffin oil (100 viscosity), and then stirred with an equal amount of water. For hard waters amylamine soaps may be made with coconut fatty acids. A 0.1 per cent. solution of monoamyl oleate has a *p*H of 9.57. A suggested use for monoamyl oleate is as a dispersing agent for an insecticide to be used for the control of onion thrips, red spider, and many types of aphids. It is said not to injure foliage.

2 Amino-2-methyl-1-propanol, 2 amino-2-methyl-1-propanediol, and tris (hydroxy-methyl) aminomethane form soaps which are soluble in both water and oils, and are therefore emulsifiers for oils, fats and waxes, and similar materials. They are useful in cosmetics, textile and leather specialties, wax polishes and coatings. The soaps are relatively stable and almost odourless. It is reported that 0.5 per cent solutions of the oleates show surface tension of 27 dynes per cm.

Guanidine Carbonate

Guanidine carbonate is an organic alkali of approximately the same strength as sodium carbonate and has the formula $(H_2N.CNH.NH_2)_2H_2CO_3$. The product is soluble in water, but slightly soluble in alcohol and acetone. Advantages ascribed to this chemical over other organic amines are that it is entirely stable under normal conditions. It is a strong base, does not cause yellowing of cosmetic emulsions, and has a combining weight of 90. In combination with stearic acid, mineral oil, and waxes it forms stable water-in-oil emulsions. Investigation of possible toxicity is being made, but the results are not yet available. In making soaps, the fatty acid should be warmed with an equal volume of alcohol before adding the guanidine carbonate, to prevent undue thickening or foaming. These soaps are soluble in alcohols, benzol, carbon tetrachloride, ethylene dichloride, naphthas, and water. Their properties indicate their use as detergents, dry-cleaning soaps, general emulsifiers and possibly cosmetics.

A Chemist's Bookshelf

THORPE'S DICTIONARY OF APPLIED CHEMISTRY, 4th Ed., Vol. IV (Digallic Acid—Feeding Stuffs), edited by Sir Jocelyn Thorpe and M. A. Whiteley. London: Longmans. Pp. xxiii and 603. 70s.

Another volume of "Thorpe" is ever a welcome addition to the works or laboratory library, and it is almost superfluous to say that the present volume maintains the high standard of its predecessors. As we commented in our "personal" column recently, the date of publication of this Vol. IV coincided with that of the untimely death of the principal Editor. His profound experience has, happily, created for future volumes a system to which his colleagues will have no hesitation in adhering. The combination of the important monograph with the short dictionary article is an admirable compromise, serving to the full the purposes of the chemical industry. Of the monographs in the present volume, the longest is that on Explosives, written shortly before his death by the late H. Shankster, Principal Chemist of the Chemical Inspection Department of Woolwich Arsenal. This deals with industrial and military explosives from all points of view, and is supported by shorter articles on Coal-Mine Explosives, by T. J. R. Alexander, of I.C.I., and D. T. A. Townend, Livesey Professor at Leeds University. The chemical engineer will be specially interested in the long articles on Drying and Desiccation, by S. G. M. Ure; on Evaporation, by J. A. Reavell; and on Industrial Extraction Apparatus, by W. C. Peck. Dyeing, with a special section on Textile Printing, is exhaustively dealt with by Ellis Clayton, of Bradford Technical College, while Azo Dyestuffs (which we should rather have expected to find in Vol. I) are described by the authoritative pen of M. Lapworth, of I.C.I. (Dyestuffs). Space forbids enlargement on as many of the absorbingly interesting monographs as we should like to describe, but a special word should be said, in view of the prime importance to-day of maintaining healthy factory conditions, about the article "Dust, Industrial, and Dust Explosions" by A. J. Holden (with a special section on Coal Dust Explosives, by T. N. Mason). Twenty-five pages are devoted to this subject, and practically every feature of the problem is dealt with, although we could find no mention of the recent work done by S. C. Blacktin on dust control.

AN INTRODUCTION TO CHEMISTRY (Part I, Inorganic Chemistry), by A. C. Cavell. London: Macmillan. Pp. 512. 6s.

This is the first part of a series which aims at providing a complete course in theoretical and practical chemistry. The present volume deals mainly with chemistry of School Certificate standard. It is noteworthy for a simple and logical lay-out, with a due supply of experiments and examination questions. A new and attractive feature is the addition of historical notes at the end of each chapter.

TRANSACTIONS OF THE INSTITUTE OF CHEMICAL ENGINEERS. Vol. 17, 1939. London: Institute of Chemical Engineers. Pp. 201.

It is doubtless merely an appropriate coincidence that the principal article in this volume, as in "Thorpe," should deal with explosives: Dr. Cullen's Presidential Address for 1939, "My Fifty Years in the Explosives Industry" is now famous, and was reviewed in THE CHEMICAL AGE at the time when it was delivered. Other important contributions which have been read and presented to the Institution are the papers by Fitzmaurice and Lea on "Floors for Industrial Purposes"; by Hewson and Rees on "Some Contributions of Chemistry and Chemical Engineering to Steam Generation"; by Quertier on "Problems of Compressors and Compressed Gases in Industry"; by Edgeworth-Johnstone on "The Transference of Chemical Processes from Small to Large-Scale Operation"; by A. K. G. Thomson on "Heat Transmission in Evaporative Condensers"; by Newitt on "The Theory of Gas Compression and Circulation"; and by Vernon on "Some Aspects of Fundamental Research on the Corrosion of Metals." The paper, "Administrative Training of the Chemical Engineer," by E. S. Byng, is of at least equal importance, and should be read in conjunction with Lord Moulton's famous lecture on "The Training and Functions of the Chemical Engineer," which was delivered in 1920, and which is reprinted in an appendix.

A SURVEY OF INSECTICIDE MATERIALS OF VEGETABLE ORIGIN, edited by H. J. Holman. London: Imperial Institute. Pp. 155. 3s. 6d.

Chemical insecticides (arsenicals, lead compounds, etc.) are still by far the most important agents of the kind, but they possess a serious disadvantage in their toxicity to man and animals. In the search for insecticides without this detriment special importance attaches to work done and in progress in connection with insecticide materials of plant origin. Information on the sources of such plant materials and their commercial production has not hitherto been readily accessible, but the survey under review, the result of work by an Imperial Institute Consultative Committee, furnishes the latest available information on the botanical sources, chemical composition, physiological action and pest control aspects of such insecticides now in use, together with world trade details. Three main sections deal respectively with (*a*) alkaloid-containing insecticides (nicotine, anabasine, etc.), (*b*) plants containing rotenone and allied compounds (derris, lonchocarpus, tephrosia, etc.), and (*c*) pyrethrum; while quassia and plant oils are described in two further sections. There is a useful bibliography and an appendix of structural chemical formulæ.

THE TOOLS OF THE CHEMIST, by Ernest Child. London: Chapman and Hall. New York: The Reinhold Publishing Corpn. Pp. 220. 21s. net.

Those who are interested in the history of the arts and sciences of mankind, and their name is legion, cannot fail to be interested in this unique book. It is in condensed form the story of the evolution of laboratory apparatus, with special reference to its development in the U.S.A., but, lest anyone should be misled into thinking that this is a book only for American readers, it should be made clear at once that practically all the fundamental forms of chemical apparatus have been developed in Europe, for the most part in Germany and Great Britain. The greater part of the book is concerned with the work of those men of European fame, most of whom never saw America, who in their own laboratories developed apparatus which they later made famous by the researches conducted with its aid. The scientific men of the early 19th century seem frequently not only to have invented or devised apparatus but to have undertaken its manufacture and sale. Many of them imported large consignments into America, orders being placed by their former students who found it necessary to come to Europe to study and to obtain their degrees. From these sources the American colleges were supplied and later the American industrial laboratories. It seems that not until the Great War of 1914 did America awake to the realisation that there was both need for, and financial advantage to be gained by, the home manufacture of scientific apparatus. The first part of the book is primarily concerned with the great names of chemistry both in Europe and America and the part they took in the development of chemical apparatus. The second portion treats of the history of specific types of apparatus, such as balances, glassware, porcelain, silica ware, filter paper, heating appliances and so forth. The system adopted in these sections is to trace the general rise and development of the apparatus until it became developed or made in U.S.A., after which the description concentrates on American history. The last section of the book concerns the history of only American firms who supply chemical apparatus as merchants, not manufacturers. The author, who is an English-born American business man, evidently knows his subject thoroughly and has produced a remarkably interesting book which we believe has no parallel. Not its least valuable and interesting feature is the 104 illustrations both of the scientific worthies of olden days and the apparatus which they produced.

Dermatitis and Plastics

Protective Methods of the Bakelite Corporation

A CONSTRUCTIVE article on Dermatitis in the Plastics Industry is contributed to the June number of *Chemical Safety* by Mr. A. H. Oak, of the personnel department of the Bakelite Corporation. Industrial dermatoses, he says, are the most common of all the ailments affecting a man as a result of his work, some authorities estimating that as high a ratio as 60 per cent. of all industrial diseases belong to this group. As a result, many ill-informed persons have rushed into print with alarming articles claiming that the problem is practically insurmountable in certain sections of the plastics industry, including that dealing with phenol-formaldehyde resins. It is therefore advisable to insist on the true facts of the case.

Some phenolic materials, as well as most aldehydes and their derivatives, are irritants ton the human skin. This property of affecting the skin is carried from the raw materials to many of the resinous products. Unfortunately the resins have to be ground to a fine powder for application to many of their uses and unless the pulverised materials are kept off the skin, dermatitis may result.

Fortunately most human beings are not easily affected, but some people are very sensitive or allergic to chemical dermatitis from resins or the raw materials used in them. Sensitivity to any of the many dermatitis-causing products can be detected to a limited extent by means of the patch test. A small amount of the product is placed on a piece of gauze, moistened with a water solution and bound against a clear spot on the person's skin with adhesive tape. If no irritation appears on the skin within 48 hours, there is a possibility that the person is immune to that particular material. If the irritation is pronounced, the person is highly allergic and should not be employed in a place where he must have the material in contact with his skin. Only about 5 per cent. of the men employed by the Bakelite Corporation are so allergic. They can be detected by the patch test. About 40 per cent. of the people who are not sufficiently allergic to be detected by the patch test may develop some dermatitis unless they are provided with protection which minimises the amount of material coming in contact with them. Protection may be obtained by three methods, no one of which is sufficient unto itself.

Three Safety Methods

A combination of three methods of protection has been found by the Corporation to reduce the dermatitis problem to infinitesimal proportions. First, liquids should be handled in closed pipe lines to reduce spillage and contact with people. Vapours should be kept out of operating areas by proper suction hoods at danger points. Dust, the greatest problem because the most prevalent and the hardest to control, must be kept in enclosed containers or, where it is handled in the open, suction hoods connected to fans and dust collectors should be applied to remove all dust at the point of origin. Secondly, the employer should provide shower baths and insist that anyone who has to come in contact with materials causing dermatitis takes a daily bath after work. Many slight cases of skin irritation are aggravated by harsh methods of cleansing. Turpentine, petrol, soda ash, harsh sand soaps and similar materials are too often used to remove paint, grease, etc., instead of the appropriate bland skin-lubricating cleansers.

Employees should be educated as to the necessity for wearing close-fitting underwear that will keep dust from their skins and be persuaded to keep clothes clean.

Thirdly, we must give protective creams or ointments credit for preventing many a dermatitis case. Inflammation of the outer skin from chafing gives irritants of a chemical nature more ready access to the sensitive under layers. Protective ointments can be applied to wrists, neck, face, hands, ankles and other points of friction difficult to cover by ordinary clothes. They put a layer or film between skin and irritant, and can easily be removed by washing.

The experience in the Bakelite plant during 1939 with cases of dermatitis can be summarised very briefly. Two new employees out of over 100 were so allergic that they were persuaded to seek work elsewhere. Among the remainder working with chemicals and finished products, less than one per cent. on the average found it necessary each month to receive treatment for rash of any kind. The hot months are always the most likely to cause trouble because men perspire more and remove more clothes, thereby increasing the exposure. The elaborate dust-collecting and suction systems, together with the continuous campaign of education on the desirability of personal and plant cleanliness, are responsible for a satisfactory record in the war on dermatoses.

The Potash Situation and the U.S.A.

Domestic Supply Meets Domestic Demand

DOMESTIC potash productive capacity in the United States is now considered sufficient to meet domestic demand, while new foreign markets for domestic potash have been opened up by the war in the partial or complete replacement of German potash in both domestic and foreign fields, states the Bureau of Mines, U.S. Department of the Interior, in a recent survey of the potash situation. The war disrupted a world monopoly held by an international syndicate comprising German, French, Polish, and Spanish producers, with reported sales agreements covering production in the U.S.S.R. and Palestine and controlling 90 per cent. of the world output, with Germany alone furnishing over 60 per cent. of the total. The blockade has stopped German shipments of potash to many nations.

Early in 1939, the world's combined capacity for the production of potash was in excess of the existing demand, says Bertrand L. Johnson, author of the survey. Over-production and destructive competition had been prevented only because of the dominance of the international potash cartel. The United States, which was outside the cartel, supplied over half its own potash consumption and exported considerable quantities, in marked contrast to its situation at the opening of the war of 1914.

Most of the German markets for natural raw potash salts were in adjacent countries still accessible to German exporters. Great Britain and the United States are the largest markets opened to other shippers. The markets for processed salts are much larger and more numerous, and many of them are now cut off from German potash. The United States, Japan, and Great Britain are the principal prospective purchasers of processed potash salts from sources other than German, but there are many others in all five continents. Several nations have an advantage over the United States in respect to sales of natural raw salts in European countries, but the United States is less handicapped in the sale of processed potash salts, especially in the more distant markets formerly exploited by Germany.

It is questionable whether expenditure on additional plant to capture new markets under the present abnormal conditions would be justified. The duration of the war cannot be foretold, and when it is over, certain general trends are likely once more to assert themselves. Developments in other countries with large potash reserves will raise the threat of overproduction, and may force the establishment of a new international cartel, which, under existing statutes, American producers will be prohibited from joining.

Personal Notes

DR. J. C. CROCKER has been appointed head of the department of chemistry at Chelsea Polytechnic in succession to Dr. C. Dorée.

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The Council of the Royal Society of Arts have re-elected SIR ATUL C. CHATTERJEE, G.C.I.E., K.C.S.I., as their chairman for the ensuing year.

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MR. A. E. GRIEVE has joined the board of Balfour, Williamson and Co., Ltd., oil importers and merchants. He is a director of Lovering China Clays, Ltd., and of Meledor Estate, Ltd.

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MR. J. H. WOOTON-DAVIES, A.I.C., head of the firm of Peter Lunt and Co., Ltd., manufacturing chemists, Aintree, has been adopted as National Conservative candidate for the Heywood and Radcliffe Division of Lancashire.

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MR. KEITH J. LAIDLER, of Liverpool College and Trinity College, Oxford, has passed the Ph.D. final examination at Princeton University, New Jersey. From Trinity he was awarded a Commonwealth Fund Fellowship at Princeton University in chemical physics.

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MR. JAMES KEWLEY, M.A., F.I.C., F.Inst. Pet., who retired at the end of last month from the position of chief chemist to the Asiatic Petroleum Co. and the Anglo-Saxon Petroleum Co. (Shell Group), has been succeeded by MR. JOHN O. ORIEL, M.C., M.A., B.Sc. Mr. Kewley was associated with petroleum chemistry for over 30 years, having joined the Shell Transport and Trading Co. in 1906. He was an original member of the Institute of Petroleum Technologists (now Institute of Petroleum) and was President in 1931-33, organising the first World Petroleum Congress in the latter year. He had done important work on plant control in the refinery, notably on the development of the pipe still in the refineries of the Shell Group.

OBITUARY

DR. JAMES THOMAS DONALD, founder and president of the chemical firm of J. T. Donald and Co., Ltd., died recently at Montreal, aged 83, in consequence of a motoring accident.

* * * *

MR. H. CHARLES L. BLOXAM, Public Analyst for Newcastle-upon-Tyne and Northumberland, whose death last week is reported, was distinguished in chemistry at home and abroad. At one time he was chief chemist to the Chilean navy, and later held chemical appointments in India and South Africa. He had also served as partner, with the late Dr. J. T. Dunn, in the firm of J. and H. S. Pattinson, of Newcastle.

* * * *

MR. CHARLES KER, who died last week in Glasgow, at the age of 80, had been a director of Mirrlees, Bickerton and Day, Ltd., of Stockport and Glasgow, manufacturers of diesel engines, centrifugal pumps, etc., from the formation of the company until two years ago. Mr. Ker was a chartered accountant by profession and was director of several engineering and other companies. He was an honorary LL.D. of Glasgow University.

New Control Orders

Import Licensing of Sulphuric Acid

APPLICATIONS for import licences for sulphuric acid should be made to the Ministry of Supply, Sulphuric Acid Control, 19 Berkeley Square, Bristol, 8. Application forms may be obtained from the Import Licensing Department, Board of Trade, 25 Southampton Buildings, Chancery Lane, London, W.C.2, or from the offices of H.M. Controllers of Customs and Excise. The direction at the head of the application form that it should be forwarded to the Import Licensing Department should be ignored.

Maleic Resins

Increased Output in U.S.A.

FIGURES recently published by the U.S. Tariff Commission disclose a substantial rise in the output of resins derived from maleic anhydride. The production for 1939 is given as 6,263,000 lb., as compared with 3,433,000 lb. in 1938 and 2,804,000 lb. in 1937.

Maleic resins are mainly used in the manufacture of high grade oil and cellulose enamels, being of particular interest for non-yellowing white stoving enamels owing to their colour fastness under all sorts of conditions. In the American statistics the maleic resins are classed as alkyds, *i.e.*, polyhydric alcohol condensation products analogous to the "glyptals" which are on the basis of phthalic anhydride. Many maleic resins are prepared, however, by condensation with rosin or a terpene such as pinene or terpinene. Maleic anhydride is manufactured by oxidation of benzene or naphthalene, so that its resins are included under the heading of coal-tar-derived resins. Abietic acid (or rosin) resins, *e.g.*, glycerine rosin ester, are grouped in the American classification under non-coal-tar resins.

Several firms are (or were prior to the war) engaged in making maleic resins in this country, well-known grades being Alresate 313C, Bedesol 72, Crestanol SB526. Typical American products are Lewisol No. 2, Teglac 161, and Petrex, the last being the trade name of a group of terpene-maleic resins with applications ranging from hard furniture lacquers to paper lacquers.

British Chemical Prices

Market Reports

THE demand for industrial chemicals has remained steady during the past week and buying has again shown greater activity for spot transactions. Little interest appears to be displayed in new forward business, but so far as existing contracts are concerned deliveries are well up to schedule. In the export field a good volume of inquiry is reported for a wide range of fine chemicals whilst a good overseas trade is proceeding in fungicides and insecticides. The price position generally remains unchanged with quotations continuing steady at recent levels. Values for caustic potash and carbonate of potash are nominal. Trade in coal tar products is reported to be on the quiet side with no special feature to record.

MANCHESTER.—New bookings on the Manchester chemical market during the past week have been no more than moderate, although most traders report that fair quantities, especially of chemicals for the textile and allied industries, are being taken up against existing contracts. With few exceptions so far as the leading heavy chemicals are concerned, values are on a steady to firm basis. A shortage of spot supplies is still in evidence in the case of the bichromates, prussiates, the potash materials generally, oxalic acid and certain other products.

GLASGOW.—As far as the Scottish heavy chemical trade is concerned, the advent of the so-called staggered holidays appears to have had the effect desired by Government, and orders during the present week have continued to come in as usual without any diminution. Although there is a slight scarcity of commodities which used to be sent from French possessions, it is expected that local substitutes will fill up the gap. Prices are still well maintained.

Price Changes

Aluminium Sulphate.—About £9 10s. per ton d/d.
Calcium Chloride.—70/75% solid, £5 11s. per ton ex store.
Chrometan.—Crystals, 4½d. per lb.; liquor, £19 10s. per ton d/d station in drums. GLASGOW: Crystals 4d. per lb. in original barrels.
Chromic Acid.—1s. 2d. per lb., less 2½%; d/d U.K. GLASGOW: 1s. 2½d. per lb. for 1 cwt. lots.
Citric Acid.—MANCHESTER: 1s. 5½d. per lb.
Copper Sulphate.—About £30 per ton d/d.
Cresylic Acid.—MANCHESTER: Pale, 99/100%, 2s. 7d.
Lithium Carbonate.—7s. per lb. net.
Methylated Spirit.—Industrial 66 O.P. 100 gals., 2s. 0½d. per gal.; pyridinised 64 O.P. 100 gals., 2s. 1½d. per gal.
Naphthalene.—MANCHESTER: Refined, £31.
Nitric Acid.—S.G. 1420, £28 10s. to £30 per ton ex works.
Sodium Phosphate.—Tri-sodium, £20 per ton d/d for ton lots.

General News——From Week to Week

BRITISH BURMAH PETROLEUM production for the month of June amounted to 54,644 barrels.

NEGOTIATIONS, IT IS REPORTED, are proceeding with the object of setting up another factory in Scotland for the production of transparent wrapping from seaweed.

STIRLINGSHIRE COUNTY COUNCIL Plans Committee have granted permission to the Scottish Enamelling Company to carry out improvements at their works at Larbert.

IT IS UNDERSTOOD that a Scottish mill is prepared to start production of paper from potato haulms, if the tests forecast in this column of our issue of June 29 at all justify the step.

THE NEW ADDRESS of British Burmah Petroleum, Rangoon Oil and Trinidad Consolidated Oilfields, is Walford House, West Monkton, near Taunton, Somerset.

HARRISON CLARK, LTD., have transferred their emergency headquarters from South Benfleet, Essex, to Preston Deanery Hall, Northampton (telephone: Hackleton 54). A skeleton staff remains at 16 Water Lane, London, E.C.3.

THE DIRECTORS OF TURNER AND NEWALL, LTD., asbestos manufacturers, Rochdale, have decided to invest the amount of £500,000 in 2½ per cent. National War Bonds 1945-47, and the actual investment of this amount has now been made.

GLASGOW DEAN OF GUILD COURT has approved of certain alterations to the premises of: Messrs. David T. Morrison and Co., Ltd., oil and paint manufacturers; Messrs. Glass Fibres, Ltd.; and Messrs. David Bennie and Sons, Ltd., iron and steel manufacturers.

THE STANDING JOINT COMMITTEE of the British Pottery Manufacturers' Federation and the National Society of Pottery Workers have agreed that notwithstanding the cancellation of the annual holiday this year payment of holiday money shall be made on the usual scale.

CORRESPONDENCE WHICH HAS HITHERTO been addressed to the managing director, Orr's Zinc White, Ltd., Widnes, should, in future, be addressed to Mr. Orr personally as follows: Donald J. W. Orr, Esq., managing director, Orr's Zinc White, Ltd., "Brunagh," Stanley Road, Hoylake, Cheshire. (Tel.: Hoylake 752.)

THE BOARD OF TRADE HAS ISSUED the Trading with the Enemy (Specified Persons) (Amendment) (No. 8) Order, 1940, which came into operation on July 10. This contains several hundred additions to the list of enemy firms in neutral country and includes two obvious chemical concerns: the Fabrica Riograndense de Adulos e Productos Chemicos S.A., of Pelotas, Brazil; and the Sauerstoff und Wasserstoffwerk A.G., of Lucerne, Switzerland. A remarkable and unexpected feature of the list is the inclusion in the Canary Islands of two firms at Funchal, Madeira.

Foreign News

PRODUCTION OF ACETIC ACID (100 per cent.) in Bulgaria increased in 1939 to 70,000 litres from 45,000 in 1938.

EXPORTS OF NITRATES from Chile were valued at 142,600,000 pesos (6d. gold), in 1939, against 141,600,000 pesos in 1938.

IMPORTATION INTO THE Federated Malay States of sulphuric acid, or of any coagulants containing sulphuric acid, is prohibited except under permit.

PRODUCTION OF CHROMITE in Sierra Leone for the period October-December, 1939, amounted to 4463 tons, against nil for the corresponding period in 1938.

THE GERMAN AUTHORITIES IN POLAND have entrusted a special commission with the control of petrol production and refining in all the Polish oil fields, states the official German News Agency.

CANADIAN INDUSTRIES, LTD., have awarded contracts for the construction of new warehouses at their Plastics Division at Brownsburg, Que., and at their fertiliser plant at Halifax, N.S., at a total cost of $50,000.

EXPORTS OF PAINTS IN MAY from Canada were valued at $184,988, against $68,636 in May, 1939. The United Kingdom was the leading purchaser, taking approximately half the total export. South Africa, New Zealand, Newfoundland, China, Aden, India and Australia were other leading purchasers.

JAPANESE RAYON AND STAPLE FIBRE manufacturers are reported by the U.S. Department of Commerce to have petitioned their Government for permission to import caustic soda, alleging that the domestic supply of the alkali is short as a result of the scarcity of imported salt.

IN AN EFFORT TO INCREASE camphor production in Japan proper from 1,400,000 to 1,800,000 kg., the Finance Ministry has raised the subsidy for crude camphor by 75 yen to 275 yen per 100 kg., and for camphor oil by 40 yen to 150 yen per 100 kg. It is reported that the present export price of 438 yen per 100 kg. will be maintained for the time being.

THE EGYPTIAN MINISTRY OF PUBLIC WORKS plans to expend £E.22,000 in the current year in manufacturing fertilisers from Cairo city refuse. The plan involves transportation of refuse from El Maghawri, the main refuse dump outside Cairo, to Gebel el Asfar, for conversion into organic fertiliser material after mixing with sewage. About 50,000 tons of refuse are available annually.

EXPORTS OF PHENOL from the United States during the first four months of 1940, according to preliminary figures published by the U.S. Department of Commerce, increased to 901,444 lb. ($124,089) from 465,764 lb. ($76,660) in the corresponding period of 1939, although shipments registered a recession from 1939 last four months' exports amounting to 1,221,239 lb. ($164,312). Three-quarters of United States shipments of phenol during the first four months of 1940 were consigned to Belgium and the United Kingdom.

A PLANT FOR THE PROCESSING of locally-produced barite is soon to be established in Cuba, according to information received in Habana. Financed and controlled by two American companies, the plant will have a mill to crush and prepare barite for use in oil-well drilling. The mill is to be in Regla, on the eastern side of the Bay of Habana, and the expected markets for the processed material are in Trinidad, Venezuela, and Colombia. Some of the product may be exported to the United States. Cuban barite is reported to be quite pure and may be used virtually without waste.

THE USE OF PLASTIC MATERIALS incorporated in artificial leather as substitutes for genuine leather has increased in Germany since the outbreak of war, according to an American consular report quoted in *World Trade Notes*. The manufacture of transmission belts from cellulose triacetate sheets is reported as an outstanding success. An effort is now being made to employ plastics in footwear, and it has been found that soles for shoes can be made by using plastic materials as agents for binding together leather waste, textile fibres, etc., in the form of artificial leather. For this purpose synthetic rubber and vinyl polymers are used.

FOR LACK OF SPECIAL MACHINERY ordered in Germany and which is not purchasable from the United States because Manchukuo lacks necessary foreign exchange, no progress was made towards completion of projected heavy industrial plants there in the first quarter of 1940. However, some concession to Japan was reported to have been made by England with regard to German deliveries to Manchukuo begun before the outbreak of the war, and some relief may be forthcoming to the numerous half-finished plants. One big state enterprise in particular, the Manchuria Sulphate of Ammonia Industry Company, formed in 1938 to produce and sell at cost chemical fertilisers to Japanese farmers, was reported to be planning to dissolve in view of the uncertainty of ever getting beyond the "blue-print stage."

ALTHOUGH NUMEROUS PLANS for the construction or extension of plants in Chosen (Korea) to produce explosives from fish oil, urea-gypsum fertilisers, carbide, caustic soda, and hydrogenated fish oils were announced in 1939, and in some cases it appears that construction has actually been undertaken, no important plants, as far as is known, were completed. Early in the year it was announced that the Chosen Nitrogen Fertiliser Company planned to increase its annual production to 600,000 tons, but it has been learned that the plan was abandoned because of lack of materials. Newspaper reports, quoted by the U.S. Department of Commerce, have stated that the same company began experimental production of diammonium phosphate from apatite in August, 1939, and that the new product may be used to replace superphosphate prepared from imported phosphate rock.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

C. E. RAMSDEN AND CO., LTD., Stoke-on-Trent, colour and chemical manufacturers. (M., 20/7/40.) July 3, £6000 mortgage to C. E. Ramsden, Stone (Staffs.); charged on Foley Colour and Chemical Works, Fenton, etc. *Nil. May 17, 1940.

J. SALMON AND SON, LTD., London, N., oil and colourmen. (M., 20/7/40.) July 3, deed supplemental to debenture dated September 15, 1913, and debenture dated December 3, 1919, in confirmation of £20,000 secured by the said debentures to Westminster Bank, Ltd.; general charge. *Nil. January 3, 1940.

PAUL QUINN, LTD., London, W.C., paint manufacturers. (M., 20/7/40.) July 2, series of £15,000 (not ex.) debentures, present issue £6500; general charge. *——. April 23, 1940.

S. STONIER, LTD., Congleton, chemical manufacturers. (M., 20/7/40.) July 5, £323 10s. 4d. charge (sec. 81, 1929 Act), to J. Lovett, Kidsgrove; charged on building, etc., on main road from Congleton to Holmes Chapel, West Heath, Congleton.

County Court Judgments

WHITTAKER HOWARTH, LTD., Bury Road, Radcliffe. (C.C.J., 20/7/40.) Soap manufacturers. £21 3s. 2d. June 7.

P.P.P. PHARMACY, LTD., R/O, 50 Park Street, N.1. (C.C.J., 20/7/40.) Manufacturing chemists. £19 16s. 11d. May 28.

Bankruptcy Proceedings

NICHOLAS, WILLIAM HENRY CECIL, 9 Wensley Green, Chapel Allerton, Leeds, manufacturing chemists' representative. (R.O., 20/7/40.) Date of Filing Petition, July 9, 1940. Receiving Order, July 9, 1940. Debtor's Petition.

Companies Winding-Up Voluntarily

MOUNT OXIDE MINES, LTD. (C.W.U.V., 20/7/40.) A general meeting of members at 19 St. Swithin's Lane, London, on Wednesday, August 28, 1940, at 12.15 p.m.

Company News

Beecham Maclean Holdings, Ltd., which is controlled by **Beechams Pills, Ltd.,** has declared a final dividend of 6.4 per cent., bringing the distribution for the year to June 30, 1940, to 27.4 per cent.

Greef-Chemicals Holdings have declared a final dividend on the ordinary shares of 5¾ per cent. (6 per cent.), less tax, making 12½ per cent. (9 per cent.) for 1939.

Sangers, Ltd., manufacturing and wholesale chemists, etc., report a record profit for the year to March 31 last of £249,796, which is some £29,000 more than the previous year's figure of £220,843. The ordinary dividend is again 25 per cent., the final payment being 15 per cent.

In addition to the dividend on the ordinary stock already reported, **Lever Brothers and Unilever, Ltd.,** at their annual general meeting last week, declared a dividend of 5 per cent. for 1939 on the preferential certificates outstanding under the co-partnership trust and a dividend of 6 per cent. on the deferred stock.

Eastwoods Cement, Ltd., is paying a final dividend of 6 per cent., bringing the payment for the year to March 31 last up to 11 per cent. (last year, 7½ per cent. and 12½ per cent.). The preliminary statement shows a trading profit of £42,747 and a net profit of £28,330, compared with £42,852 and £28,505 respectively in 1938-39.

New Companies Registered

Robert Blackie, Ltd. (362,123).—Private company. Capital £25,000 in 25,000 ordinary shares of £1 each. To acquire the business of a manufacturing and wholesale chemist and druggist carried on at Shen Works, Melon Road, S.E.15, by Robert Blackie. Directors: Robert Blackie, Laurance J. S. Lane. Secretary: John F. Chapman. Registered office: Shen Works, Melon Road, Peckham, S.E.15.

Mamaco Manufacturing Co., Ltd. (362,351).—Private company. Capital £200 in 200 ordinary shares of £1 each. Manufacturers of and dealers in chemicals, gases, drugs, medicines, etc. Subscribers: Albert E. Zeumer, Mrs. Nancy F. Zeumer. Albert E. Zeumer is the sole director. Registered Office: 25 Cheapside, E.C.2.

Powder Metallurgy (1940), Ltd. (362,214).—Private company. Capital £1000 in 1000 shares of £1 each. To acquire the business metallurgy and powder metallurgy, and in relation to industrial diamonds, dealers in hydrides, tungsten-carbide, titanium carbide and other carbide-compounds, iron and steel and other metals, etc. Directors: Wm. D. Jones, Geo. T. Lunt, and James E. Hurst. Registered office: 101 Leadenhall Street, E.C.3.

L. R. Laboratories, Ltd. (362,070).—Private company. Capital £5,000 in 5,000 ordinary shares of £1 each. Objects: To carry on business as manufacturers of and dealers in chemical products, particularly fire-extinguishers and fire-fighting appliances, etc. The directors are: Chas. H. N. Adams, 1 South Square, W.C.1; Edward B. Orr, Louis Roney. Solicitors: Hunt and Co., 1 South Square, Grays Inn, W.C.1.

Chemical Trade Inquiries

British West Indies.—An agent established at Kingston, Jamaica, wishes to obtain the representation, on a commission basis, of United Kingdom exporters of pharmaceuticals and drugs for the British West Indies, Bermuda and British Guiana. (Ref. No. 438.)

Chemical and Allied Stocks and Shares

SENTIMENT on the Stock Exchange has been governed by the widespread tendency to await the Supplementary Budget, and business outside Government securities has been at a low ebb. On the other hand, general willingness to take more than a short view was again reflected by absence of heavy selling of good class stocks and shares. It is, of course, difficult to form any definite opinion as to the outlook for securities of individual companies until details of the Budget are known.

Although, where changed, shares of chemical and kindred companies have moved to slightly lower levels in accordance with the surrounding market tendency, in many instances prices were well maintained on balance for the week. Greeff-Chemicals Holdings 5s. units remained at 5s. 7½d. aided by the good impression created by the financial results, showing the raising of the dividend from 9 per cent. to 12½ per cent. Borax Consolidated deferred kept around 21s. 3d., and William Blythe 3s. shares transferred at 5s. 3d., while B. Laporte were quoted at 45s., and Monsanto Chemicals 5½ per cent. preference shares at 21s. 3d. Imperial Chemical reacted to 23s. 9d. and the 7 per cent. preference were 29s. The prevailing view is that there seem reasonable possibilities of the dividend on I.C.I. ordinary shares remaining around 8 per cent., on which basis the yield at the current price is nearly 7 per cent., which is in line with the yields on many other leading industrial securities.

Fison Packard were again around 30s., and British Glues 4s. shares continued to be quoted at 3s. 9d., while business in Erinoid 5s. ordinary shares took place at 2s. 6d. Low Temperature Carbonisation 2s. shares remained at 1s. 1½d. awaiting publication of the financial results. Lever and Unilever at 20s. were unchanged on balance, and British Oil and Cake Mills preferred ordinary were maintained at 31s. 7½d. Aided by the increased profits shown by the results of Lansil, Ltd., there was a firmer undertone in rayon shares, and Courtaulds kept around 25s. pending declaration of the interim dividend. Triplex Glass again transferred around 18s. 6d., but few dealings were shown in United Glass Bottle and other shares of glass companies. Associated Cement and shares of other cement manufacturers lost the firmer tendency which developed last week. British Plaster Board 5s. ordinary were quoted at 7s. 6d.

Stewarts and Lloyds were firm around 32s. 9d., and United Steel were inclined to improve, but Staveley shares were easier at 39s. 6d. Allied Ironfounders improved slightly to 7s. 6d. General Refractories 10s. shares continued to be priced at around 6s. and Imperial Smelting at 6s. 6d. Dunlop Rubber transferred around 25s. Turner and Newall, British Oxygen and other widely-held shares reflected the easier market tendency, but very little selling was reported. Shares of retail and kindred companies failed to respond to the dropping of the Purchase Tax, the prevailing factor being the disposition to await the coming Budget. Boots Drug were 35s., Sangers 17s. 6d., Timothy Whites 16s. 10½d., and Beechams deferred 6s. 9d. Elsewhere, British Drug Houses were steady at 22s. 6d., but the quotation was not tested by dealings. Pinchin Johnson were 1s. down at 16s. 6d., and Lewis Berger reacted to 40s. Goodlass Wall at 6s. 3d. were the same as a week ago. Michael Nairn moved down to 40s., but Barry and Staines were unchanged at 23s. 9d. Wall Paper Manufacturers deferred went back to 10s. 7½d.

Moderately lower prices ruled for leading oil shares, but sentiment was not affected by the passing of the Royal Dutch dividend, as this had been expected in view of the similar decision made by "Shell" Transport.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Applications for Patents

MANUFACTURE OF ESTERS.—Soc. of Chemical Industry in Basle. Sept. 16, 1938. (Cognate Applications, 25837-8/39.) 25836/39.

PROCESS FOR THE FRACTIONAL SEPARATION OF HYDROCARBON MIXTURES.—Universal Oil Products Co. Sept. 16, 1938. 25856/39.

CRACKING OR COKING HYDROCARBON OILS.—N.V. Nieuwe Octrooi Maatschappij. Sept. 21, 1937. (Divided out of 27163/38.) 4997/40.

Complete Specifications Open to Public Inspection

MANUFACTURE AND TREATMENT OF POLYMERISATION PRODUCTS.—Röhm and Haas Ges. Aug. 8, 1938. (Cognate Application, 22879/39.

MELT SPINNING OF POLYMERIC MATERIALS.—E. I. du Pont de Nemours and Co. Aug. 9, 1938. (Cognate Application, 23046/39.) 23045/39.

MELT SPINNING of organic filament-forming compositions.—E. I. du Pont de Nemours and Co. Aug. 9, 1938. 23047/39.

PRODUCTION OF COLOUR RESISTS under aniline-black.—Durand and Huguenin A.-G. Aug. 11, 1938. 23089/39.

METHACRYLATE RESIN EMULSIONS for leather finishes.—E. I. du Pont de Nemours and Co. Aug. 10, 1938. 23146/39.

VAT DYESTUFF MIXTURES.—I. G. Farbenindustrie. Aug. 17, 1938. 22993/39.

PREVENTION OF THE AUTOXIDATION OF CHEMICAL SUBSTANCES.—T. Tabalitschka and E. Bohm. Aug. 18, 1938. (Cognate Application, 22997/39.) 22996/39.

PREPARATION OF ALKYLATED AROMATIC SULPHONIC ACIDS.—I. G. Farbenindustrie. Aug. 18, 1938. (Cognate Application, 23076/39.) 23075/39.

PROCESS FOR THE PREPARATION OF ALUMINIUM SULPHATE.—Montecatini Soc. Generale per L'Industria Mineraria e Chimica. Aug. 12, 1938. 23107/39.

MANUFACTURE OF AZO DYESTUFFS.—Soc. of Chemical Industry in Basle. (Cognate Application, 23197/39.) 23196/39.

PRODUCTION OF AZO DYESTUFFS containing metal.—I. G. Farbenindustrie. Aug. 19, 1938. (Cognate Application, 23408/39.) 23407/39.

RESINOUS COMPOSITIONS.—British Thomson-Houston Co., Ltd. Aug. 13, 1938. 23235/39.

LAKE PIGMENTS, and enamel compositions containing the same. E. I. du Pont de Nemours and Co. Aug. 16, 1938. 23264/39.

PROCESS FOR THE PRODUCTION OF ALIPHATIC-AROMATIC AMINES.—F. Kulz. Aug. 16, 1938. 23427/39.

PLASTIC MASSES.—Dynamit A.-G. vorm. A. Nobel and Co. Aug. 15, 1938. 23436/39.

SYNTHETIC RESINS, and friction elements made therefrom.—Bakelite, Ltd. Aug. 18, 1938. 23451/39.

PROCESS FOR SEPARATING EMULSIONS.—M. Biazzi. Aug. 15, 1938. 23493/39.

MANUFACTURE OF UNSATURATED ESTERS.—British Celanese, Ltd. Aug. 16, 1938. 23519/39.

UREA RESIN.—I. Rosenblum. Aug. 19, 1938. 23532/39.

PROCESSES FOR THE PRODUCTION OF SELENIUM RECTIFIERS.—Patentverwertungs-Ges. Hermes. Aug. 15, 1938. 23571/39.

METAL CRUCIBLES for salt bath furnaces.—Deutsche Gold und Silber-Scheideanstalt vorm. Roessler. Aug. 19, 1938. 23650/39.

MANUFACTURE OF POLYMERISATION PRODUCTS.—Rohm and Haas Ges. Aug. 16, 1938. 23651/39.

MANUFACTURE OF POLYMERIC MATERIALS, and of products prepared therefrom.—Imperial Chemical Industries, Ltd. Aug. 16, 1938. 23690/39.

PRODUCTION OF CADMIUM COATINGS.—Deutsche Gold und Silber-Scheideanstalt vorm. Roessler. Aug. 17, 1938. 23747/39.

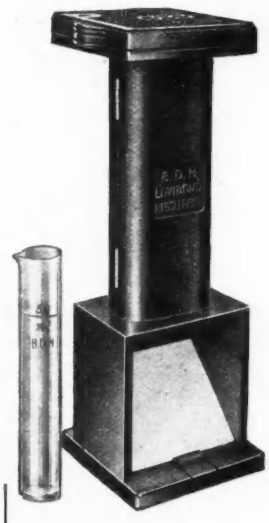
Specifications Accepted with Date of Application

DYEING AND FINISHING OF TEXTILE MATERIALS.—Calico Printers' Association, Ltd., L. A. Lantz, and W. S. Miller. Aug. 12, 1938. 519,343.

MAGNESIUM ALLOYS.—G. von Giesche's Erben. Sept. 21, 1937. (Addition to 490,712.) 519,302.

MAKING ALLOYS containing iron, chromium, silicon and carbon. M. J. Udy. Sept. 7, 1938. 519,303.

MANUFACTURE OF SYNTHETIC RESINS.—I. G. Farbenindustrie. (Sept. 13, 1937.) (Cognate Application, 26744/38.) 519,175.



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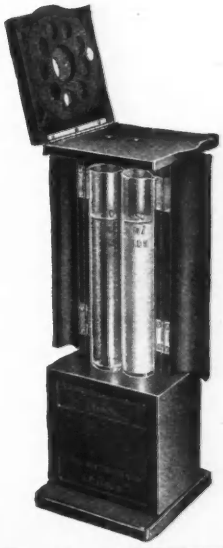

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THE Proprietor of British Patents Nos. 445,776 and 445,777, both dated March 29, 1934, and both relating to "METHOD OF CALCINING DIATOMACEOUS EARTH" desires to arrange by licence or otherwise on reasonable terms to exploit the above patents and ensure their practical working in Great Britain. Inquiries to Singer, Ehlert, Stern and Carlberg, Steger Building, Chicago, Illinois.